THE CLAIMS

1. A film measurement apparatus comprising:

a light source configured to generate a light signal;

a fiber optic cable connected to said light source to receive said light signal and further configured to direct said light signal onto a sample to obtain a reflected light signal having a plurality of wavelength components, each having an intensity;

a one-spatial-dimension imaging spectrometer configured to receive said reflected light signal, and derive therefrom a plurality of electrical signals, each representative of the intensity of a wavelength component of the reflected light;

a translation mechanism to scan the measured sample under the one-spatial-dimension imaging spectrometer;

a computer configured to receive from said one-spatial-dimension imaging spectrometer said plurality of electrical signals, and determine therefrom the thickness of at least one film on said sample, by:

obtaining data representative of the intensity of at least some of said wavelength components by scanning the sample with the said one-spatial-dimension imaging spectrometer;

arranging said data so that two-spatial-dimension spectral image is formed;

analyzing at least one wavelength component of the said two-spatial-dimension spectral image to find one or more pre-determined measurement locations; and

providing a measurement of the thickness of one or more layers in at least one region of the sample by analyzing the spectral reflectance data obtained from that region.

2. The apparatus of claim 1 in which the scanning motion of the one-spatial-dimension spectroscopic imager relative to the sample is provided by moving the one-dimensional spectroscopic imager.

3. The apparatus of claim 1 where the measurement locations are determined by analyzing the spectral data.

4. The apparatus of claim 1 where other film properties besides film thickness, such as optical constants and doping density, are determined from the spectral reflectance data.

5. The apparatus of claim 1 where the sample translation mechanism is an integral part of equipment used for the manufacture of semiconductor microelectronics.

6. A film measurement apparatus comprising:

a light source configured to generate a light signal;

a one-spatial-dimension imaging spectrometer configured to receive light from said light source that has been reflected or transmitted by a sample, and derive therefrom a plurality of signals, each signal representative of the intensity of a wavelength component of the reflected or transmitted light at a particular location;

a computer configured to receive from said one-spatial-dimension imaging spectrometer said plurality of signals, and determine therefrom the properties of at least one film in at least one region of said sample, by analyzing the spectral data obtained from that region.

7. The apparatus of claim 6 where a translation mechanism is used to move the measured sample relative to the one-spatial-dimension imaging spectrometer to obtain a series of one-spatial-dimension spectral images of the sample.

8. The apparatus of claim 6 where a translation mechanism is used to move the one-spatial-dimension imaging spectrometer relative to the measured sample to obtain a series of one-spatial-dimension spectral images of the sample.

9. The apparatus of claim 6 where moving mirrors or lenses are used to obtain a series of one-spatial-dimension spectral images of the sample.

10. The apparatus of any of claims 7, 8, or 9 where the resultant one-spatial-dimension spectral images are combined to form a two-spatial-dimension image of the sample.

11. The apparatus of claim 10 where at least one wavelength component of the said two-spatial-dimension spectral image is analyzed to find one or more pre-determined measurement locations.

12. The apparatus of claim 6 where the film property to be determined is thickness.

13. The apparatus of claim 6 where the film property to be determined is refractive index.

14. The apparatus of claim 6 where the film property to be determined is extinction coefficient.

15. The apparatus of claim 6 where the one-spatial-dimension imaging spectrometer communicates the measured light intensity to the computer via an optical communication link.

16. The apparatus of claim 6 where the one-spatial-dimension imaging spectrometer communicates the measured light intensity to the computer via wireless communications.

17. The apparatus of claim 7 where the sample translation mechanism is an integral part of equipment used for the manufacture of semiconductor microelectronics.

18. A method for measuring the properties of a film on a sample by:

forming a line image from light reflected off of or transmitted through a corresponding region of the sample;

individually dissecting one or more subportions of the line image into relevant constituent wavelength components, thereby forming a spectral line image; and

individually analyzing the resultant spectral data representative of the relevant constituent wavelength components of the one or more subportions to determine one or more properties of the film.

19. The method of claim 18 further comprising successively formed one-spatial dimension spectral data representative of successive portions of the sample.

20. The method of claim 19 where the successively formed spectral data representative of successive portions of the sample are combined to form a two-spatial-dimension spectral image of the sample.

21. The method of claim 20 further comprising determining one or more measurement locations from the two-spatial-dimension spectral image of the sample.

22. The method of claim 18 wherein the film property to be determined is thickness.

23. The method of claim 18 where the film property to be determined is refractive index.

24. The method of claim 18 where the film property to be determined is extinction coefficient.

25. A film measurement system comprising:

a light source configured to generate a light signal;

a one-spatial-dimension imaging spectrometer configured to receive light from said light source that has been reflected or transmitted by a sample, and derive therefrom a plurality of signals, each signal representative of the intensity of a wavelength component of the reflected or transmitted light at a particular location;

a computer configured to receive from said one-spatial-dimension imaging spectrometer said plurality of signals, and determine therefrom the properties of at least one film in at least one region of said sample, by analyzing the spectral data obtained from that region.

26. The system of claim 25 where a translation mechanism is used to move the measured sample relative to the one-spatial-dimension imaging spectrometer to obtain a series of one-spatial-dimension spectral images of the sample.

27. The system of claim 25 where a translation mechanism is used to move the one-spatial-dimension imaging spectrometer relative to the measured sample to obtain a series of one-spatial-dimension spectral images of the sample.

28. The system of claim 25 where moving mirrors or lenses are used to obtain a series of one-spatial-dimension spectral images of the sample.

29. The system of any of claims 26, 27, or 28 where the resultant one-spatial-dimension spectral images are combined to form a two-spatial-dimension image of the sample.

30. The system of claim 29 where at least one wavelength component of the said two-spatial-dimension spectral image is analyzed to find one or more pre-determined measurement locations.

31. The system of claim 25 where the film property to be determined is thickness.

32. The system of claim 25 where the film property to be determined is refractive index.

33. The system of claim 25 where the film property to be determined is extinction coefficient.

34. The system of claim 25 where the one-spatial-dimension imaging spectrometer communicates the measured light intensity to the computer via an optical communication link.

35. The system of claim 25 where the one-spatial-dimension imaging spectrometer communicates the measured light intensity to the computer via wireless communications.

36. The system of claim 26 where the sample translation mechanism is an integral part of equipment used for the manufacture of semiconductor microelectronics.